

FIFTH ANNUAL REPORT

OF THE

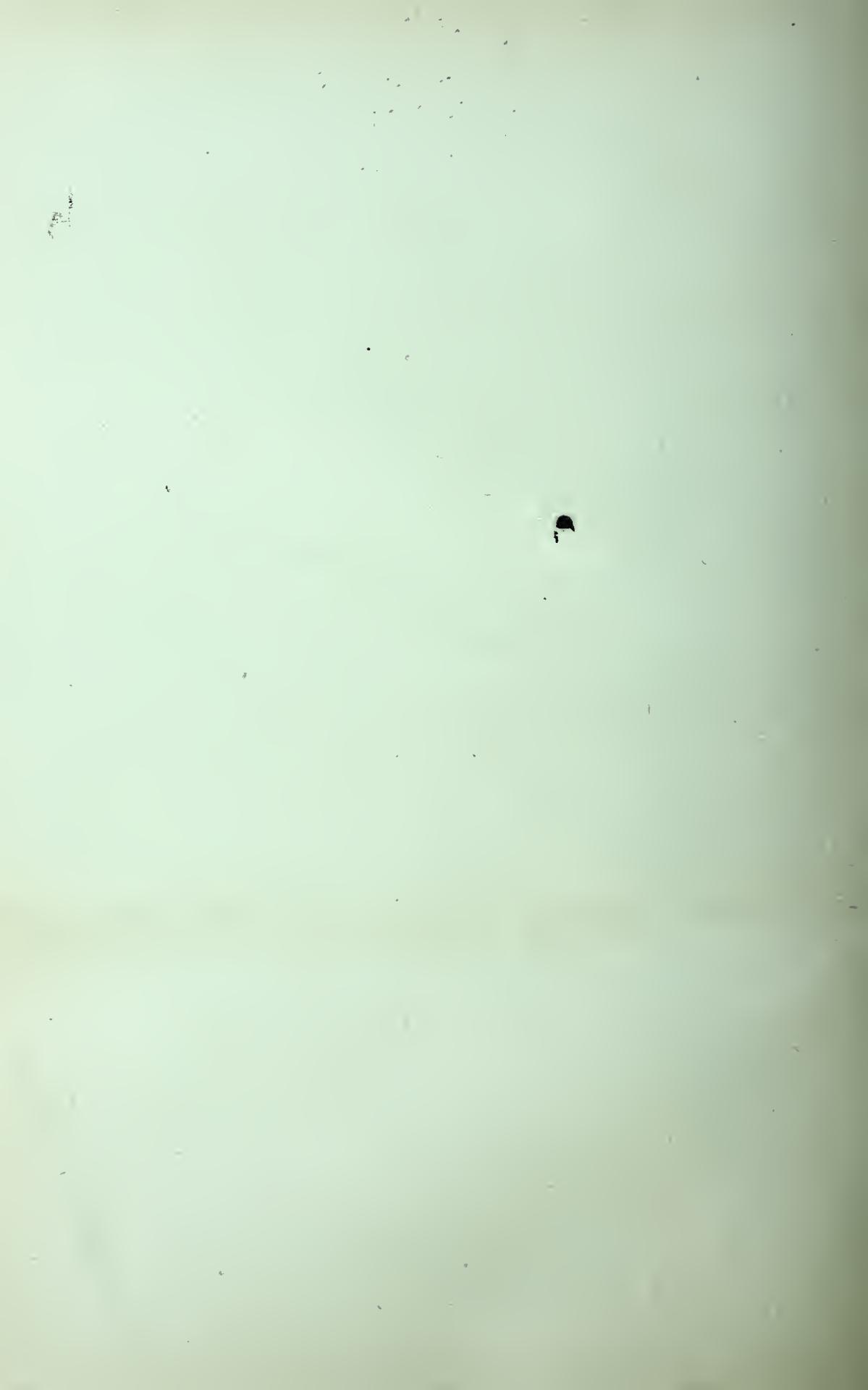
EXPERIMENT STATION,

KANSAS STATE AGRICULTURAL COLLEGE,

FOR THE YEAR 1892.

MANHATTAN, KANSAS.

1893.





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EXPERIMENT STATION
OF THE
KANSAS STATE
AGRICULTURAL COLLEGE.

REPORT FOR 1892,
CONSISTING OF THE
FIFTH ANNUAL REPORT
AND
BULLETINS 33 TO 37.

MANHATTAN, KANSAS.
1893.

KANSAS STATE AGRICULTURAL COLLEGE.

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* Term expires.

STATION STAFF.

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President of the College.

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N. S. MAYO, D. V. S., M. Sc.,
Professor of Physiology and Veterinary Science.

A. S. HITCHCOCK, M. Sc.,
Professor of Botany.

I. D. GRAHAM, B. Sc., *Secretary*.

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FRED. A. MARLATT, B. Sc.	<i>Entomology</i> .
F. C. BURTIS, B. Sc.	<i>Agriculture</i> .
WM. SHELTON	<i>Foreman of the Farm</i> .
M. A. CARLETON, B. Sc.	<i>Botany</i> .

KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN, KAS., January 31, 1893.

To His Excellency Governor L. D. LEWELLING:

DEAR SIR—I herewith transmit, as required by act of Congress approved March 7, 1887, the fifth annual report of the Experiment Station of the Kansas State Agricultural College, for the year 1892, including the financial statement to June 30, 1892.

Respectfully yours,

GEO. T. FAIRCHILD,

Secretary Board of Regents.

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EXPERIMENT STATION
OF THE
KANSAS STATE AGRICULTURAL COLLEGE,
MANHATTAN.

FIFTH ANNUAL REPORT—FOR THE YEAR 1892.

FINANCIAL STATEMENT.

REPORTS OF TREASURER.

To the Board of Regents of the Kansas State Agricultural College:

GENTLEMEN—Herewith is submitted my report of receipts and expenditures on account of the Experiment Station, for the period between June 30, 1891, and May 1, 1892:

Received from the Treasurer of the United States.....	\$11,250 00
Paid approved vouchers, Nos. 1 to 209.....	<u>11,228 67</u>
Balance paid to Joshua Wheeler, Treasurer elect.....	\$21 33

Respectfully submitted. JNO. E. HESSIN, *Treasurer.*

To the Board of Regents of the Kansas State Agricultural College:

GENTLEMEN—I herewith present my report of receipts and expenditures on account of the Experiment Station, for the period between May 1, 1892, and June 30, 1892, inclusive:

Received from Jno. E. Hessin, former Treasurer.....	\$21 33
Received from the Treasurer of the United States.....	<u>3,750 00</u>
Total receipts.....	\$3,771 33
Paid approved vouchers, Nos. 210 to 301.....	<u>3,771 33</u>

Respectfully submitted. JOSHUA WHEELER, *Treasurer.*

REPORT OF THE SECRETARY.

To the Board of Regents of the Kansas State Agricultural College:

GENTLEMEN—Herewith is submitted the following statement of the financial affairs of the Experiment Station of the Kansas State Agricultural College, for the year ending June 30, 1892. The several items of this ac-

count are covered by vouchers approved by the disbursing officer, certified by the Secretary, and allowed by the President of the Board of Regents. The accounts covering the Station fund are kept in a separate set of books, as provided in the act of Congress under which the Station was organized, and duplicate vouchers covering every item of expenditure made during the year are on file in the office of the Secretary.

DR.

To appropriation for the year ending June 30, 1892, under act of Congress approved March 2, 1887.....	<u>\$15,000 00</u>
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CR.

June 30. By Salaries.....	\$9,086 57
Labor	1,887 38
Apparatus	361 03
Supplies.....	321 04
Printing.....	2,758 05
Stationery.....	20 65
Postage	26 94
Library.....	27 51
Live stock.....	17 00
Traveling.....	194 80
Freight.....	174 41
Photographs.....	44 00
Office furniture.....	60 00
Telegram.....	62
Membership, A. A. A. C. & Ex. Sta.....	20 00
Total.....	<u>\$15,000 00</u>

Respectfully submitted, I. D. GRAHAM, *Secretary.*

REPORT OF THE FINANCE COMMITTEE.

We, the finance Committee of the Board of Regents of the Kansas State Agricultural College, having duly examined vouchers Nos. 1 to 301, for \$15,000, received and expended on account of the Experiment Station during the fiscal year ending June 30, 1892, and having diligently compared the same with the books of the Secretary, hereby certify both books and vouchers to be correct.

Respectfully submitted,	R. P. KELLEY, F. M. CHAFFEE, R. W. FINLEY, <i>Committee.</i>
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REPORT OF THE COUNCIL.

To the Board of Regents of the Kansas State Agricultural College:

GENTLEMEN—We herewith present in brief the fifth annual report of the Kansas Experiment Station, covering the work of the calendar year 1892, and a statement of accounts for the fiscal year ending June 30, 1892.

As heretofore, all the available space upon the farm and grounds has been used in experiments in some form, and many plats of sugar beets have been secured in various parts of the State. The results of many of the experiments have been published in the annual series of bulletins, Nos. 33 to 37 inclusive, paged consecutively, and fully indexed in this report. Their contents in outline are given herewith. On account of unfavorable weather, the results of experiments with corn and with oats were not very satisfactory, and as the publication of data at this time was therefore of less importance, no bulletins appear. In the next season's report of continuous experiments, these data will be included so far as they may have any interest.

OUTLINE OF BULLETINS.

BULLETIN No. 33. August, 1892. Farm Department.

Experiments with wheat [pp. 1-50]: Containing details of the following experiments: (1) Wheat continuously without manure. (2) Wheat in rotation; comprising 10 rotations with wheat as the basis. (3) Time of seeding; the results of seeding at different dates, from September 10 to October 30. (4) Mature and immature seed wheat; results of using seed cut in the milk, in comparison with ripe seed. (5) Pasturing wheat; the effects of grazing it off during fall and spring, in comparison with wheat not pastured. (6) Amount of seed per acre; details of results by the use of different quantities, from one-half to two bushels per acre. (7) Effects of light and heavy seed wheat. (8) Methods of seeding; comprising the use of the roller drill, shoe drill, and lister, in comparison with each other and with broadcasting. (9) Test of varieties; a comparison of 238 varieties.

BULLETIN No. 34. September, 1892. Farm Department.

Experiments in feeding steers [pp. 51-98]: Giving results of feeding, for six months, four lots of five steers each, as follows: Lot 1, tied up in barn, fed mixture of corn meal, oil meal, bran and shorts, with corn fodder and prairie hay. Lot 2, tied up in barn, fed corn meal, corn fodder, and prairie hay. Lot 3, tied up in barn, fed ear corn, corn fodder and prairie hay. Lot 4, fed in open yard, ear corn, corn fodder, and prairie hay. History of steers: First cost of steers; weight at time of purchase; weight at time of beginning experiment; method of feeding; prices of feed; weekly summary of feed, weight and gain of each lot; monthly summary of feed, weight, gain, cost of feed, and cost per pound of gain; weekly mean

temperature during feeding period, in barn and in yard; relation of feed and water to gain; comparison of live weight, shrinkage, and dressed weight; financial data; nutrients in feeds used; relation of grain to proteins and carbohydrates in feed consumed; comparison of results.

BULLETIN No. 35. December, 1892. Veterinary Department.

Actinomycosis bovis, or "lump jaw" of cattle [pp. 99-112]: Giving results of an investigation of the disease known as "lump jaw" of cattle; prevalence; symptoms; age at which it occurs; location of tumor; course, cause, treatment; use of diseased flesh as food.

Some observations upon loco [pp. 113-119]: Description of loco weed; experiment with loco upon Guinea pigs; field observations; effect of loco upon cattle and horses; treatment.

BULLETIN No. 36. December, 1892. Chemical Department.

Experiments with sorghum for sugar content [pp. 121-137]: Sorghum—Comparison of varieties; analyses of general samples; analyses of single stalks; improvement by seed selection; trial with fertilizers.

Sugar beets—in 1891 and 1892 [pp. 138-150]: Instructions for growing; directions for taking and sending samples; analyses of sugar beets sent to the Station; analyses of sugar beets grown by the Station.

BULLETIN No. 37. December, 1892. Horticultural Department.

Experiments in potato culture [pp. 151-160]: A comparison of the use of first-crop and second-crop potatoes for seed; flat culture *vs.* hill culture.*

OTHER WORK.

CHEMICAL DEPARTMENT.—Other work not yet reported upon includes an inquiry into the effects of certain foods upon the quantity and composition of milk, an investigation of the chemical changes that take place in the silo, the composition of Soy beans preserved dry and in the silo, the analysis of feeding stuffs, and the nitrogen compounds of rain water.

HORTICULTURAL DEPARTMENT.—In entomology, the character of the work has largely remained as outlined in the last report, and has resulted in the record of a great number and variety of observations upon the habits and character of injurious insects, with studies looking toward their field control. Extended experiments with different insecticides and methods for application were planned for the destruction of the cabbage worm, and important data secured. As the trials were partially inconclusive, through unfavorable weather, the publication of the results is deferred until after a repetition of some of the details. Studies of the grape-leaf hopper were made, and contrivances and methods looking to its destruction were put into operation, with favorable results. The matter pertaining to this insect will soon be made ready for publication, it being desirable, however, to confirm certain conclusions by additional studies the coming season.

In the garden, the matters under trial included, incidentally, variety tests

of the cabbage, sweet corn, beans, peas, and tomatoes, and, especially, culture methods, the effect of various fertilizers, and the influence upon production of repeated or deferred removal of the fruit. Some of these trials, among them the sweet corn and the later plantings of cabbage, came to naught, through the dry weather of the summer. Others will be duly presented in bulletins, in appropriate connection. The lists of small fruits on trial have been increased by the addition of many sorts not before on the trial grounds, and cultural tests have been provided for, especially among strawberries, by the extension of the plantations.

As bearing upon the still-discussed question of the value of certain methods of working the apple, a large series of grafts were made, according to the following scheme: Whip grafts, in lots of 100, with stocks and cions as described; the cions in lots I, II and III being, in each case, two feet long, one foot long, and six inches long, respectively, and the entire lot being repeated throughout with each of the four varieties—Ben Davis, Winesap, Maiden's Blush, and Missouri Pippin.

A—Whole root, graft above crown; cion I, II, III.

AA—Whole root, graft below crown; cion I, II, III.

B—Root five inches long, graft above crown; cion I, II, III.

BB—Root five inches long, graft below crown; cion I, II, III.

C—Root $2\frac{1}{2}$ inches long, graft above crown; cion I, II, III.

CC—Root $2\frac{1}{2}$ inches long, graft below crown; cion I, II, III.

D—Piece roots, $2\frac{1}{2}$ inches long, small; cion I, II, III.

E—Piece roots, $1\frac{1}{2}$ inches long, standard size; cion I, II, III.

F—Piece roots, $1\frac{1}{2}$ inches long, small; cion III.

These will be treated with uniformity, and future comparisons will be published.

FARM DEPARTMENT.—Besides experiments reported in Bulletins Nos. 33 and 34, work has been completed, so far as the season has allowed, in experiments with oats, corn, and forage plants. Owing, however, to the absence in Europe, under a Government commission, of the Agriculturist during the winter, the results, only partially satisfactory, could not be published in time to be of any service for the spring seeding. They will, therefore be published in connection with the work of 1893 in the same line. The ground covered by these unpublished experiments is briefly as follows:

Experiments with Oats.—Seeding on spring-plowed, fall-plowed and unplowed land; treating oats with hot water for smut; single variety *vs.* a mixture of varieties; amount of seed that should be sown to the acre to give best yields; methods of seeding oats; the effects of light and heavy seed oats; stage of ripeness at which to cut oats for seed; time of harvesting oats; varieties of oats.

Experiments with Corn.—Results of using butt, middle and tip kernels for seed; distance at which to plant corn for ensilage; distance at which to plant corn for grain and fodder; frequency of cultivation of corn; deep and shallow culture of corn; listed and surface-planted corn; large and

small kernels for seed; cutting corn at different stages of maturity; effect of removing tassels from corn; test of varieties of corn.

Experiments with Forage Plants.—Distance at which to plant Red Kaffir corn for seed and fodder; culture of Soy beans for hay; culture of Soy beans for seed.

Feeding Experiments are in progress with 20 steers, which are fed essentially in the same manner as the steers fed last winter, and reported upon in Bulletin 34; also feeding experiments with the Soy bean, to ascertain its value, when fed at the various stages of growth, for the production of milk.

VETERINARY DEPARTMENT.—Other work, not as yet reported upon in the bulletins, is as follows:

The collection of material and the preliminary work for the investigation of the so-called "cornstalk disease," which it is hoped to complete as soon as outbreaks of the disease occur which can be investigated.

An outbreak of Texas fever among cattle near Emporia was inspected and studied, and remedies tried.

The investigation of *Actinomycosis bovis*, or lump jaw, is being continued, with a view to determine, if possible, the life history of the organism which causes the disease.

Some work has also been done to determine whether fistulous withers in horses is caused, in some cases, by germs. An effort is also being made to determine how long the spermatozoa of stallions will retain their activity outside of the animal body, as this has a very important bearing upon the artificial impregnation of mares, especially barren mares.

All inquiries regarding sick stock from various parts of the State have been answered, and treatment suggested.

BOTANICAL DEPARTMENT.—The work carried on by the Botanical Department, none of which has been published, is as follows:

During the year, notes were taken on the rusts of grain, including the germination of the spores in various chemicals, the wintering of the fungus, the distribution in the State, and the effect of spraying with fungicides. The results will appear in a forthcoming bulletin.

A large number of experiments were tried to determine the effect of fungicides upon the germinating power of corn.

Observations have been recorded concerning our weeds, especially their germination and the character of their seedlings.

THE STAFF.

No changes have been made in the Council, or in the efficient corps of assistants named in last year's report. Mr. S. C. Mason, assistant in horticulture, retains that position still, though appointed Assistant Professor of Horticulture in the College. Mr. William Shelton, foreman of the farm, has accepted a place as manager of the Shaw dairy farm, at Wayland,

Mass., and will leave in February. Mr. D. H. Otis, a graduate of the College in 1892, will take the place of second assistant in agriculture.

EXECUTIVE MATTERS.

All expenditures have been made, as usual, after estimates approved by the Council, and authorized by the Board of Regents. Publication of bulletins has been under direction of the Council, in an edition of 7,000, distributed by the Secretary to the newspapers of the State and to farmers applying for them. This edition is proving insufficient, but the Council feels unable to increase it to any great extent, for want of means. The State would do well to provide for publication with other State documents, as has been done in several States.

The Station was a second time represented in the State fair, by an extensive display of products, carefully labeled, to show the object sought in their cultivation. The display was highly complimented for its extent and completeness in the several departments. The general expenses of the exhibit were borne by the College, as a part of its usual outlay for advertising.

The Station correspondence has been quite extended, so as to occupy the attention of the several members of the Council with questions of detail almost daily. The general correspondence as to publications has been, as usual, in the hands of the Secretary. Publications of other stations have been kept on file in the Secretary's office, accessible to all, until complete volumes can be bound, when they are deposited in the College library.

The work planned for 1893 varies but little from that of the past year, except that the tests of varieties will be somewhat curtailed, and the comparisons of methods will be extended. A more careful system of beet culture in various parts of the State is provided for, and the feeding experiments will be varied.

Appended are acknowledgments of donations, and a list of the various publications of the Station since its origin.

Respectfully submitted,

GEO. T. FAIRCHILD.

GEO. H. FAILYER.

E. A. POPENOE.

C. C. GEORGESON.

N. S. MAYO.

A. S. HITCHCOCK.

PUBLICATIONS PREVIOUS TO 1892.

BULLETINS.

- No. 1, April, 1888, "Organization, Equipment, and Aims."
- No. 2, April, 1888, "Experience with Cultivated Grasses and Clovers."
- No. 3, June, 1888, "Life History of two Orchard Pests."
- No. 4, September, 1888, "Experiments with Wheat."
- No. 5, December, 1888, "Sorghum, and Sorghum Blight."
- No. 6, July, 1889, "Silos and Ensilage."
- No. 7, August, 1889, "Experiments with Wheat."
- No. 8, October, 1889, "Preliminary Report on Smut in Oats."
- No. 9, December, 1889, "Experiment in Pig Feeding."
- No. 10, May, 1890, "Notes on Conifers for Kansas Planters."
- No. 11, July, 1890, "Experiments with Wheat."
- No. 12, August, 1890, "Preliminary Experiments with Fungicides for Stinking Smut of Wheat."
- No. 13, August, 1890, "Experiments with Oats."
- No. 14, December, 1890, "Winter Protection of Peach Trees, and Notes on Grapes."
- No. 15, December, 1890, "Additional Experiments and Observations on Oat Smut made in 1890."
- No. 16, December, 1890, "Experiments with Sorghum and Sugar Beets."
- No. 17, December, 1890, "Crossed Varieties of Corn, Second and Third Years."
- No. 18, December, 1890, "Experiments with Forage Plants."
- No. 19, December, 1890, "Germination of Weeviled Peas—Garden Notes on Potatoes, Beans, and Cabbage."
- No. 20, July, 1891, "Wheat."
- No. 21, August, 1891, "Stinking Smut of Wheat."
- No. 22, August, 1891, "Smut of Oats; Smut and Rust of Wheat."
- No. 23, August, 1891, "Smut of Sorghum and Corn."
- No. 24, September, 1891, "Staggers of Horses."
- No. 25, December, 1891, "Sorghum for Sugar."
- No. 26, December, 1891, "Varieties of the Strawberry."
- No. 27, December, 1891, "Crossed Varieties of Corn,"
- No. 28, December, 1891, "The Experimental Vineyard."
- No. 29, December, 1891, "Oats."
- No. 30, December, 1891, "Corn."

No. 31, December, 1891, "Sugar Beets."

No. 32, December, 1891, "Feeding Stuffs, and the Development of Grain Crops. Soy Beans."

REPORT FOR 1888.—CONTENTS.

Waste of Manure in Summering Manures in the Yard.

Experiments in the Corn Field.

Experiments with Wheat, including Bulletin No. 4.

Forage Crops.

The Milk and Butter Product as Influenced by Feeding.

The Pressure of Ensilage on the Walls of the Silo.

Relation of Rainfall to the Corn Crop.

Shrinkage of Hay in the Mow.

A Comparison of Varieties of Sorghum, including part of Bulletin No. 5.

A Test of the Keeping Qualities of Sorghum.

An Examination of Individual Stalks of Sorghum, with a View to Improving the Plant.

A Trial of Fertilizers on Sorghum.

A New Method of Milk Analysis for the use of Dairymen.

Spraying in the Apple Orchard.

Observations upon Injurious Insects, including Bulletin No. 3.

Trials of Varieties of Potatoes.

Trials of Varieties of Peas.

Trials of Varieties of Tomatoes.

Sorghum Blight, including part of Bulletin No. 5.

Hackberry Knot.

Experiments in Fertilization of Varieties of Corn.

Germination of Weed Seeds.

The Fungous Parasites of Weeds.

REPORT FOR 1889.—CONTENTS.

Experiments with Corn, Wheat, and Forage Crops, including Bulletin No. 7.

Silos and Silage, including Bulletin No. 6.

Pig-Feeding Experiment, including Bulletin No. 9.

Pigs from Mature and Immature Parents.

Work upon Sorghum.

Analysis of Feeding Stuffs.

Composition of Corn at Different Stages of Growth.

Ammonia and Nitric Acid in Atmospheric Waters.

Comparative Trials of Garden Beans, of Peas, of Potatoes, of Tomatoes.

Some Insects Injurious to the Bean.

Loose Smuts of Cereals, including Bulletin No. 8.

Crossing Varieties of Corn, First Year.

Receptivity of Corn Silk.

REPORT FOR 1890.—CONTENTS.

Summary of Bulletins 10 to 19, with index, and outline of other work undertaken.

REPORT FOR 1891.—CONTENTS.

Summary of Bulletins 20 to 32, with index, and outline of other work undertaken.

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NOTICE.

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